



IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Appl. No. : 10/054,010 : Confirmation No.: 5486
Applicant : Barry Gelernt et al.
Filed : 01/21/2002
For : VAPOR FLOW CONTROLLER

Art Unit : 3742
Examiner : Leonid M. Fastovsky

Docket No. : 06161 USA
Customer No. : 23543

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	<u>Rosaleen P. Morris-Oskanian</u>
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APPEAL BRIEF UNDER 37 CFR 1.192(b)

Sir:

Responsive to the Advisory Action Before the Filing of an Appeal Brief after the Final Rejection in the Office Action of 13 December 2004 in which Claims 1-19 were finally rejected under 35 USC §103(a), Applicants respectfully request reversal of the Final Rejection and allowance of the claims.

REAL PARTY IN INTEREST

The assignee of record, Air Products and Chemicals, Inc., is the real party in interest.

RELATED APPEALS AND INTERFERENCES

There are no related appeals or interferences to the present case and its appeal.

STATUS OF CLAIMS

Claims 1-18 were originally in the case. Claims 1, 5-7, 9-11, and 13 were amended and new claim 19 was added after the second Office Action of 16 April 2004. The claims on appeal are Claims 1-19.

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STATUS OF AMENDMENTS

No amendments have been filed after the issuance of the Final Rejection in the Office Action of 13 December 2004.

SUMMARY OF CLAIMED SUBJECT MATTER

The claimed invention describes a vapor flow controller apparatus (10) that is used for the delivery of chemical reagent vapors from a liquid phase source material (103). In claims 1-18, the vapor flow controller apparatus comprises, *inter alia*, an electronic control module (110) that is electrical communication with the flow rate controller (e.g., adjustable pressure regulator) (100a) and vaporizer module (113) to deliver the chemical reagent vapors through the vaporized gas outlet (119) at a certain flow rate based upon information received from the vaporizer module (113). In claim 19, the vapor flow controller apparatus comprises, *inter alia*, an evaporative surface (201), a heat source (203), and a sensor (202) in electrical communication with the evaporative surface (201) and electronic control module (110) wherein the amount of liquid phase source material (103) introduced into the vaporizer module (113) and/or the heat source (203) are controlled by the electronic control module (110) based upon information obtained from the sensor (202).

With the electronic control module (110), Applicants can control the output of chemical reagent vapor from the vaporizer module (113) by maintaining the evaporative surface (201) at a constant temperature. The liquid phase source material (103) vaporizes on the evaporative surface (201) at a certain temperature. As the liquid phase source material (103) vaporizes upon the evaporative surface (201) to provide the chemical reagent vapor, the evaporative surface (201) cools thereby reducing the ability of evaporative surface (201) to vaporize additional liquid phase source material (103). To counteract the cooling of the evaporative surface (201), the electronic control module (113) may, for example, increase the temperature of the evaporative surface (201) by increasing the energy input to the heat source (203) of the evaporative surface (201) and/or decreasing the amount of the liquid phase material (103) that is introduced onto the evaporative surface (201) (e.g., by varying the pressure of inert gas by adjustable pressure regulator (100a) on the pressurized inert gas container (100) through conduit (1) and shut-off valve 102' that is impressed onto the surface of liquid phase source material (103)). As a result, the process of vaporizing the liquid phase source material (103) on the evaporative surface (201) is used to directly effect the mass

flow rate of the chemical reagent vapors (see, e.g., paragraphs [0018] – [0019] and Figure 3).

GROUND OF REJECTION TO BE REVIEWED ON APPEAL

Independent claim 1 and claims 2, 4-6, 9, 12-14 and 16 which depend therefrom, independent claim 18, and independent claim 19, stand rejected under 35 U.S.C. § 103(a) as allegedly being anticipated by U. S. Pat. No. 5,952,046 (“Chayka”) in view of U. S. Pat. No. 4,436,974 (“McMenamin”).

Dependent claim 3 remains rejected under 35 U.S.C. § 103(a) by Chayka in view of McMenamin and further in view of U. S. Pat. No. 6,098,964 (“Schmitt”).

Dependent claims 7-8 remain rejected under 35 U.S.C. § 103(a) by Chayka in view of McMenamin and further in view of U. S. Pat. No. 5,556,479 (“Bran”).

Dependent claims 9-11 remain rejected under 35 U.S.C. § 103(a) by Chayka in view of McMenamin and further in view of U. S. Pat. No. 4,539,221 (“Jacob et al.”).

Dependent claim 15 remains rejected under 35 U.S.C. § 103(a) by Chayka in view of McMenamin and further in view of U. S. Pat. No. 4,321,031 (“Woodgate”).

Dependent claim 17 remains rejected under 35 U.S.C. § 103(a) by Chayka in view of McMenamin and further in view of U. S. Pat. No. 5,966,499 (“Hinkle et al.”).

ARGUMENT

When evaluating a claim for determining obviousness, all elements of the claim must be evaluated. *In re Evanega*, 4 USPQ2d 1249 (Fed. Cir. 1987). The obviousness rejections of the claims should be removed because none of the cited references teach or suggest, *inter alia*, “an electronic control module that is in electrical communication with the flow rate controller and the vaporizer module to deliver the chemical reagent vapors through the vaporized gas outlet at a certain flow rate based upon information received from the vaporizer module” as required in claims 1 and claims 2-17 which depend therefrom and claim 18 and “a vaporizer module comprising: an evaporative surface, a heat source, and a sensor in electrical communication with the evaporative surface and the electronic control module wherein the amount of liquid phase source material introduced into the vaporizer module and/or the heat source are controlled by the electronic control module based upon information obtained from the sensor” as required in claim 19. Applicants maintain that the Chayka and McMenamin references -alone or in combination with each other and/or the

other cited references- fail to disclose all of the required elements of the claims nor does the Chayka and McMenamin references -alone or in combination with each other and/or the other cited references- provide a motivation, suggestion or teaching of the desirability of making the specific invention claimed by the Applicants. While the Chayka and McMenamin references are in the same field of endeavor as the Applicants' present invention, namely providing a material in a vaporized form in order to transport it to a process chamber, neither reference recognizes that the act of vaporizing the material itself could be used to directly determine the mass flow rate of the material transported.

The § 103(a) Rejections by Chayka in view of McMenamin:

Chayka describes a delivery system wherein a liquid source 114 stored in reagent reservoir 112 is vaporized in vaporizer 136 and delivered to a reactor 142 (see Chayka at Fig. 3 and col. 11, lines 39-64). A liquid mass flow controller 150 is used to conduct liquid directly from the reagent reservoir 112 to vaporizer 136 (see *id.* at col. 11, lines 48-52). Chayka regulates the amount of liquid source that enters into vaporizer 136 through a liquid mass flow controller 150 (see *id.* at col. 11, lines 48-52). Chayka fails, however, to disclose, *inter alia*, an electronic control module that is in electrical communication with the vaporizer module to directly influence the flow rate of the chemical reagent vapors based upon information obtained from the vaporizer module, as required in Applicants' claims.

The combination of Chayka with McMenamin fails to render obvious the claimed invention, nor is there any teaching, suggestion, or motivation within any of these references to make the combination. McMenamin -like Chayka- does not teach, *inter alia*, an electronic control module that is in electrical communication with the vaporizer module to directly influence the flow rate of the chemical reagent vapors based upon information obtained from the vaporizer module. Further, McMenamin does not use a vaporizer to produce a vapor. Instead, McMenamin teaches a bubbler-type delivery system wherein a carrier gas is bubbled through liquid 14 in bubbler 10, is saturated with the vapor, and then transported with the entrained vapor to the system. A vapor mass flow controller 40 receives inputs from bubbler 10 such as temperature of the material (see temperature sensor 42) and pressure of the head space of bubbler 10 (see pressure sensor 50) to adjust the valve controlling the carrier gas flow 26 (see col. 4, lines 15-20 and Figure 1). These inputs are used to calculate the vapor mass flow using the following mathematical expression:

$$m^* = AF_c (1 + B\Delta T - C\Delta P - DF_c + E\Delta L)$$

wherein

m^* = Approximate vapor mass flow

F_c = Carrier gas mass flow

ΔT = Temperature variation from nominal ($T - T_o$) (T is bubbler temperature)

ΔP = Pressure variation from nominal = ($P - P_o$) (P is total bubbler pressure)

ΔL = Change in liquid level = $-\int m^* dt$ (L is liquid level in bubbler)

A , B and C = Positive constants computed for each chemical and nominal operating conditions; and

D and E = Positive or negative constants computed for each chemical and nominal operating conditions (see Abstract; col. 3, lines 45-69 through 15; col. 6, lines 39-69 through col. 7, lines 1-25; and claims 1-2 and 4-7)

As explained above, McMenamin's method uses inputs from bubbler 10 (e.g., bubbler temperature, bubbler or head space pressure, liquid level, etc.) to provide a calculated vapor mass flow rate. This is far different from Applicants' real-time method which uses the act of vaporizing itself based upon information received from the vaporizer module to maintain a certain mass flow rate.

Chakya and McMenamin are not properly combinable because the modification to either or both references to meet the claimed invention would destroy the intent, purpose, or function of the process described in the reference. In this regard, McMenamin describes a process for calculating a mass flow rate using a mathematical expression that is based upon inputs obtained from bubbler 10 itself and factoring in "empirically observed correction factors, dependent upon bubbler geometry, temperature, liquid level, and flow rate" (see col. 3, lines 45-69 through col. 4, lines 1-8). The mathematical expression used in McMenamin to calculate mass flow rate cannot be used with Chayka or any of the other cited references because McMenamin's expression is based upon inputs from a bubbler rather than a vaporizer. A vaporizer would not provide the necessary inputs needed to calculate the mass flow rate using McMenamin's process. Because the modification would prevent the process described in McMenamin from working for its intended purpose, the combination of McMenamin and Chayka would not render obvious Applicants' claimed invention.

Accordingly, reconsideration and withdrawal of the §103 rejections of the claims over the combination of Chayka and McMenamin is respectfully requested.

The § 103(a) Rejections of Dependent claims 3, 7-8, 9-11, 15 and 17 by Chayka in view of McMenamin and further in view of Schmitt, Bran, Jacob et al., Woodgate, or Hinkle et al., respectively:

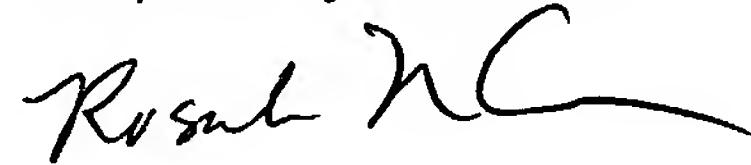
As mentioned previously, Applicants maintain that the Chayka and McMenamin references -alone or in combination with each other and/or the other cited references- fail to disclose all of the required elements of the claims nor does the Chayka and McMenamin references -alone or in combination with each other and/or the other cited references- provide a motivation, suggestion or teaching of the desirability of making the specific invention claimed by the Applicants. The cited references do not cure the deficiencies of Chayka and McMenamin in meeting Applicants' claimed invention. Further, the mathematical expression used in McMenamin to calculate mass flow rate cannot be used with Chayka or any of the other cited references because McMenamin's mathematical expression to calculate mass flow rate is based upon inputs from a bubbler rather than a vaporizer. Like Chayka, the cited references Schmitt, Woodgate, and Hinkle et al., use a vaporizer to transport liquid source material to a processing chamber (see Schmitt vaporizer (14) in Figure 1; see Woodgate vapor generator (5) in Figure 1 and col. 5, lines 10-50; see Hinkle et al. vapor converter (14) in Figure 1 and col. 6, lines 63-67 through col. 7, lines 1-9). Cited references Bran and Jacob et al. are silent as to disclosing a vaporizer or other means for transforming a liquid source material to a vapor. Bran discloses a method and apparatus for during semiconductor wafers using heating elements 54 which may be "quartz halogen lamps with dichroic mirrors" (see Bran at col. 5, lines 49-65). Jacob et al. discloses a process for the chemical vapor deposition of oxidic particles by heating a gas mixture using induction or resistance heating (see Woodside at col. 2, lines 48-57). Accordingly, reconsideration and withdrawal of the §103 rejections of the claims over the combination of Chayka and McMenamin in view of and further in view of Schmitt, Bran, Jacob et al., Woodgate, or Hinkle et al. is respectfully requested.

SUMMARY

In light of these remarks distinguishing the prior art, Applicant respectfully requests reconsideration, reversal and allowance of the claimed invention at the Board's earliest convenience.

The fee of \$500 for this Brief, as well as any additional charge or credit, is authorized to be charged to the Deposit Account referenced in the accompanying Form PTO/SB/17.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Rosaleen P. Morris-Oskanian". The signature is fluid and cursive, with the first name "Rosaleen" written in a larger, more prominent script than the last name "Morris-Oskanian".

Rosaleen P. Morris-Oskanian
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APPENDIX
CLAIMS ON APPEAL

1. (Previously presented) A vapor flow controller apparatus for delivery of chemical reagent vapors from a liquid phase source material, said controller comprising:
- (a) a source container containing said liquid phase source material;
 - (b) a pump to transport said liquid phase source material to a vaporizer module, said pump having a flow rate controller;
 - (c) said vaporizer module having a source material inlet, a carrier gas inlet, and a vaporized gas outlet, said vaporizer module adapted to convert said liquid phase source material to a vapor;
 - (d) a source material conduit for passage of said liquid phase source material from said source container to said source material inlet of said vaporizer module;
 - (e) a carrier gas container containing a carrier gas, said carrier gas container having a carrier gas outlet conduit controlled by a mass flow controller;
 - (f) said flow rate controller adapted to provide flow of said liquid phase source material into said vaporizer module through said source material conduit at a desired mass flow rate, said mass flow controller adapted to provide flow of said carrier gas at a corresponding controlled rate such that said liquid phase source material is vaporized and then is entrained in said carrier gas and carried out of said vaporizer module through said vaporized gas outlet; and
 - (g) an electronic control module that is in electrical communication with the flow rate controller and the vaporizer module to deliver the chemical reagent vapors through the vaporized gas outlet at a certain flow rate based upon information received from the vaporizer module.

2. (Original) The vapor flow controller apparatus of claim 1, wherein said source container is at ambient temperature.
3. (Original) The vapor flow controller apparatus of claim 1, including a particulate filter on said source material conduit.
4. (Original) The vapor flow controller apparatus of claim 1, wherein said corresponding controlled rate provided by said mass flow controller is approximately 10 standard cubic centimeters per minute to approximately 5 standard liters per minute.
5. (Original) The vapor flow controller apparatus of claim 1, wherein said vaporizer module comprises a vaporization chamber and a source of heat on an evaporative surface.
6. (Previously presented) The vapor flow controller apparatus of claim 5, wherein said vaporization chamber is a quartz vaporization chamber.
7. (Previously presented) The vapor flow controller apparatus of claim 5, wherein said source of heat is radiant energy device.
8. (Original) The vapor flow controller apparatus of claim 7, wherein said radiant energy device includes at least one quartz-iodine lamp and a focusing mirror.
9. (Previously presented) The vapor flow controller apparatus of claim 1 5, wherein said source of heat provides energy sufficient to heat and maintain said evaporative surface in a

range within an approximate temperature range of 80 degrees Celsius to 420 degrees Celsius.

10. (Previously presented) The vapor flow controller apparatus of claim 1 5, wherein said source of heat is a resistive heating device.

11. (Previously presented) The vapor flow controller apparatus of claim 1 5, wherein said source of heat is an inductive heating device.

12. (Original) The vapor flow controller apparatus of claim 1, wherein said vaporizer module includes a thermal sensor to sense temperature of said evaporative surface.

13. (Previously presented) The vapor flow controller apparatus of claim 12, wherein the electronic control module regulates a duty cycle of said source of heat, based on a signal from said thermal sensor, to maintain said evaporative surface at a constant temperature.

14. (Original) The vapor flow controller apparatus of claim 1, wherein said vaporized gas outlet provides flow of said vapor to a reactor for use in manufacture of semiconductor devices.

15. (Original) The vapor flow controller apparatus of claim 5, wherein said liquid phase source material has a latent heat of vaporization associated therewith which cools said evaporative surface, said cooling counteracted by said source of heat, wherein power input to said source of heat to maintain said evaporative surface at a constant temperature is

directly proportional to mass flow of said liquid phase source material provided out said vaporized gas outlet.

16. (Original) The vapor flow controller apparatus of claim 1, wherein said pump comprises inert gas in a pressurized inert gas container, said inert gas container having an outlet and an inert gas conduit between said inert gas container outlet and said source container, and said flow rate controller is an adjustable pressure regulator to regulate pressure of said inert gas in said inert gas container.

17. (Original) The vapor flow controller apparatus of claim 16, wherein said pressure regulator provides for flow of liquid phase source material in a range within an approximate range of 0.1 grams/minute to 35 grams/minute.

18. (Previously presented) A vapor flow controller apparatus for delivery of chemical reagent vapors from a liquid phase source material, said controller apparatus comprising:

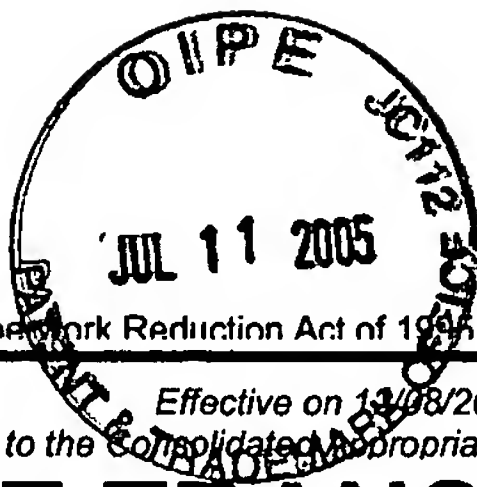
- (a) a source container containing said liquid phase source material;
- (b) an inert gas in a pressurized inert gas container, said inert gas container having an outlet regulated by an adjustable pressure regulator;
- (c) an inert gas conduit between said inert gas container outlet and said source container;
- (d) a vaporizer module having a source material inlet, a carrier gas inlet, and a vaporized gas outlet, said vaporizer module adapted to convert said liquid phase source material to a vapor;

- (e) a source material conduit for passage of said liquid phase source material from said source container to said source material inlet of said vaporizer module;
- (f) a carrier gas container containing a carrier gas, said carrier gas container having a carrier gas outlet conduit controlled by a mass flow controller; and
- (g) said pressure regulator adapted to provide flow of said inert gas through said inert gas conduit, into said source container such that said liquid phase source material is forced into said vaporizer module through said source material conduit at a desired mass flow rate, and said mass flow controller is adapted to provide flow of said carrier gas at a corresponding controlled rate such that said liquid phase source material is vaporized and then is entrained in said carrier gas and carried out of said vaporizer module through said vaporized gas outlet; and
- (h) an electronic control module that is in electrical communication with the flow rate controller and the vaporizer module to deliver the chemical reagent vapors through the vaporized gas outlet at a certain flow rate based upon information received from the vaporizer module.

19. (Previously presented) A vapor flow controller apparatus for delivery of chemical reagent vapors from a liquid phase source material comprising:

- (a) a source container containing said liquid phase source material;
- (b) a pump to transport said liquid phase source material to a vaporizer module, said pump having a flow rate controller;
- (c) an electronic control module in electrical communication with flow rate controller and a vaporizer module;

- (d) a vaporizer module comprising: an evaporative surface, a heat source, and a sensor in electrical communication with the evaporative surface and the electronic control module wherein the amount of liquid phase source material introduced into the vaporizer module and/or the heat source are controlled by the electronic control module based upon information obtained from the sensor.



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PTO/SB/17 (12-04)

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Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT (\$) 500.00

Complete if Known

Application Number	10/054,010
Filing Date	January 1, 2002
First Named Inventor	Barry Gelernt, et al.
Examiner Name	Leonid M. Fastovsky
Art Unit	3742
Attorney Docket No.	06161 USA

METHOD OF PAYMENT (check all that apply)

☐ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): _____
☒ Deposit Account Deposit Account Number: 01-0493 Deposit Account Name: Air Products and Chemicals, Inc.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

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FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

Application Type	FILING FEES		SEARCH FEES		EXAMINATION FEES		Fees Paid (\$)
	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	Fee (\$)	Small Entity Fee (\$)	
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	Fee (\$)	Small Entity Fee (\$)
Each claim over 20 or, for Reissues, each claim over 20 and more than in the original patent	50	25
Each independent claim over 3 or, for Reissues, each independent claim more than in the original patent	200	100
Multiple dependent claims	360	180

Total Claims _____ **Extra Claims** _____ **Fee (\$)** _____ **Fee Paid (\$)** _____
_____ - 20 or HP = _____ x 50 = _____
HP = highest number of total claims paid for, if greater than 20

Indep. Claims _____ **Extra Claims** _____ **Fee (\$)** _____ **Fee Paid (\$)** _____
_____ - 3 or HP = _____ x 200 = _____
HP = highest number of independent claims paid for, if greater than 3

Multiple Dependent Claims
Fee (\$) _____ **Fee Paid (\$)** _____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper, the application size fee due is \$250 (\$125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets _____ **Extra Sheets** _____ **Number of each additional 50 or fraction thereof** _____ **Fee (\$)** _____ **Fee Paid (\$)** _____
_____ - 100 = _____ / 50 = _____ (round up to a whole number) x 250 = _____

4. OTHER FEE(S)

Non-English Specification, \$130 fee (no small entity discount)

Other: Filing a brief in support of an appeal

Fees Paid (\$)
500

SUBMITTED BY

Signature		Registration No. (Attorney/Agent)	47,321	Telephone	610-481-8169
Name (Print/Type)	Rosaleen P. Morris-Oskanian			Date	7-7-2005

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